

# **Airfield Obstruction Reduction Initiative Report**

**In response to  
SAF/IG Report of Review of  
Misawa AB, Japan Runway Construction/Repair Project**

**Developed by  
Air Force Tiger Team**

**Members:  
AF/ILE (Lead)  
AF/SE  
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AF/SC**

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# EXECUTIVE SUMMARY

In Jan 00, CSAF directed AF/IL and AF/SC to respond to a SAF/IG Report of Review of construction and repair projects at Misawa Air Base, Japan (Aug-Oct 99) by reviewing processes relating to design, approval and construction of airfield structures. In addition, AF/IL was directed to conduct an Air Force-wide assessment for compliance with frangible construction.

AF/ILE led this initiative and formed a cross-functional Tiger Team to execute CSAF's directive. The team had three primary objectives: evaluate the IG recommendations, survey the Air Force and establish an integrated funding strategy to mitigate airfield obstructions across the Air Force, and recommend changes to current policies and procedures to improve the current situation. The team established guidelines for MAJCOMs to identify all airfield obstructions, assess them using principles of operational risk management, and provide costs to mitigate those obstructions. In addition, the team hosted a cross functional working group to review processes and develop recommendations for improvements. This is what they found:

- Several good initiatives exist to mitigate obstructions; however base and MAJCOM personnel need additional funding to remove existing obstructions and additional guidance and procedures to prevent them from recurring
- Validated the IG recommendations to develop/update policy, directives, and guidance to ensure frangibility requirements are incorporated into the design and construction of airfield lights, instrument landing system (ILS), equipment, etc.
- An excessive number of airfield obstructions exist; causes: inadequate funding, need for improved policy/oversight
- All obstructions are not created equal - the highest risk obstructions fall closest to the runway and in the clear zones at the ends of the runway
- Need to raise the level of awareness of flight safety impacts of airfield obstructions by
  - Strengthening oversight by Commanders and establish oversight by higher headquarters
  - Strengthening communication and coordination among cross-functionals involved in identifying, installing and managing items on the airfield

An initial data call in Mar 00 revealed more than 9900 airfield obstructions Air Force-wide. MAJCOMs provided this number by consolidating data from base annual waiver packages. While this number is alarming, keep in mind this is the first time a focus like this has ever been placed on airfield obstructions. CSAF's directive prompted commanders everywhere to respond by taking a hard look at their situation, put their arms around their problems and redouble their efforts to mitigate the hazards. After refining the scope, this number now stands at approximately 2000 that require Air Force attention. The heightened awareness created by the tiger team's requests for information motivated bases to move swiftly and remove or mitigate those obstructions that were low cost/no cost.

Using PACAF's risk-based model as a guide, the tiger team selected areas that denote differing levels of threat to flight safety. PACAF's model was selected because it offers a straightforward way to categorize risks and in turn prioritize requirements. CSAF recently supported their model when he approved funding to mitigate "critical-risk" obstructions throughout PACAF. Analysis of Air Force and Federal Aviation Administration mishap data

confirm the highest threat to flight safety occurs directly adjacent to the runway and off the ends in the clear zone. Using this data, the Air Force selected three areas emanating concentrically outward from the runway and labeled them priority areas 1 through 3. Obstructions falling within these areas pose risks to flight safety with items closest to the runway - within 350 feet of the runway centerline and 500 in the clear zone, extending 2000 feet beyond the threshold - labeled as “critical.”

Following the CSAF’s decision to fund removal of “critical- risk” obstructions at Misawa the tiger team established a goal of eliminating all “critical-risk” obstructions Air Force-wide by 2010. To achieve that goal, it will require an investment of \$10-15M per year, starting in FY03. Total MAJCOM requirements indicate 500 obstructions and project costs of \$122M to mitigate “critical-risk” obstructions. The funding strategy in Section 2 shows total requirements to mitigate all obstructions in all three areas at more than \$1 billion. By approving this funding strategy, the Air Force shows their commitment to endorse the CSAF’s message and take action to mitigate hazards that pose the highest risk to flight safety.

Base and MAJCOM personnel have been proactive in finding better ways to manage the airfield waiver program. Policy has been recently updated to clarify responsibilities, programs have been developed to put a focus on flight safety, and state-of-the-art geographical information systems allow base and MAJCOM personnel to better manage airfield obstructions. Despite the efforts to find better ways to manage the airfield waiver program, it is clear base personnel need assistance. The recommendations in this report will provide that assistance. They improve the awareness of everyone involved, from the commander on down. They provide badly needed training across the board. They propose policy changes to clarify roles and responsibilities, reduce unnecessary work and afford more time to focus on mitigating obstructions. These recommendations will ensure existing and new structures - essential to support flying operations - are frangible wherever possible. Where frangibility is not possible, structures should be constructed of low mass design to minimize damage to aircraft if struck. These recommendations will also prevent unnecessary obstructions from showing up on the airfield. Approving the funding strategy will make existing structures frangible and remove or modify those that need to stay. In summary, implementing these recommendations will reduce the risks to flight safety.

# INTRODUCTION

This is a HQ USAF-directed project to examine airfield obstructions and their impact on flight safety. This report contains three sections:

Section 1 - Current Situation - Findings and Recommendations, Initiatives

Section 2 - Funding Strategy - Obstruction Mitigation Data and Project Costs

Section 3 - Background - Definitions, airfield policies and criteria, flight safety history

In Mar 00, a survey of all MAJCOMs revealed more than 9900 airfield obstructions existed on Air Force installations. These obstructions include any natural or man-made object that violates airfield or heliport clearances, or projects into imaginary airspace surfaces (Figure 1). Knowing that obstructions closer to the runway pose a greater risk to flight safety, the focus of this study was narrowed to include an area 1000 feet on both sides of the runway (also known as the primary surface) and an area 3000 feet by 3000 feet (also known as the clear zone), from the runway ends (Figure 2). The result identified approximately 2000 obstructions in the primary surface and clear zones that require Air Force attention. Some of these include airfield lighting, Air Traffic Control and Landing Systems (ATCALS) and other essential equipment for flight operations. Others are items that were installed when bases were constructed under less stringent standards. The rest are items the Air Force needs to examine closely to determine if they must be there at all and address associated risks to flight safety.

A number of these obstructions can be mitigated either by removal, making them flush with the ground surface, or making them frangible so they break away when a force is applied. Air Force policy requires any obstruction falling within the primary surface and clear zone to be identified and labeled either a “permissible deviation” (visual and navigational aid facilities essential to airfield operations, and frangible if possible) or “exemption” (items constructed before 1964.) Examples of deviations include: approach lights, instrument landing system localizer antennas, radar facilities, etc. Items not falling within these categories require a waiver. One waiver can contain several obstructions, for example, a clump of trees that require removal or trimming. Waivers are intended to allow deviations from standards when compliance cannot be achieved. Waivers can be permanent (a natural geographic feature that is not practical to remove) or temporary (construction activities that violate space criteria). Temporary waivers should be programmed for replacement. Annually, MAJCOMS are required to review and approve waiver packages from bases.

This initiative has generated several basic questions concerning airfield obstructions and flight safety. What can be done to mitigate existing obstructions? What can be done to prevent future obstructions from being placed in the vicinity of the airfield? What are the levels of risk? Can all airfield equipment be made frangible? Answers to these questions are included in this report.

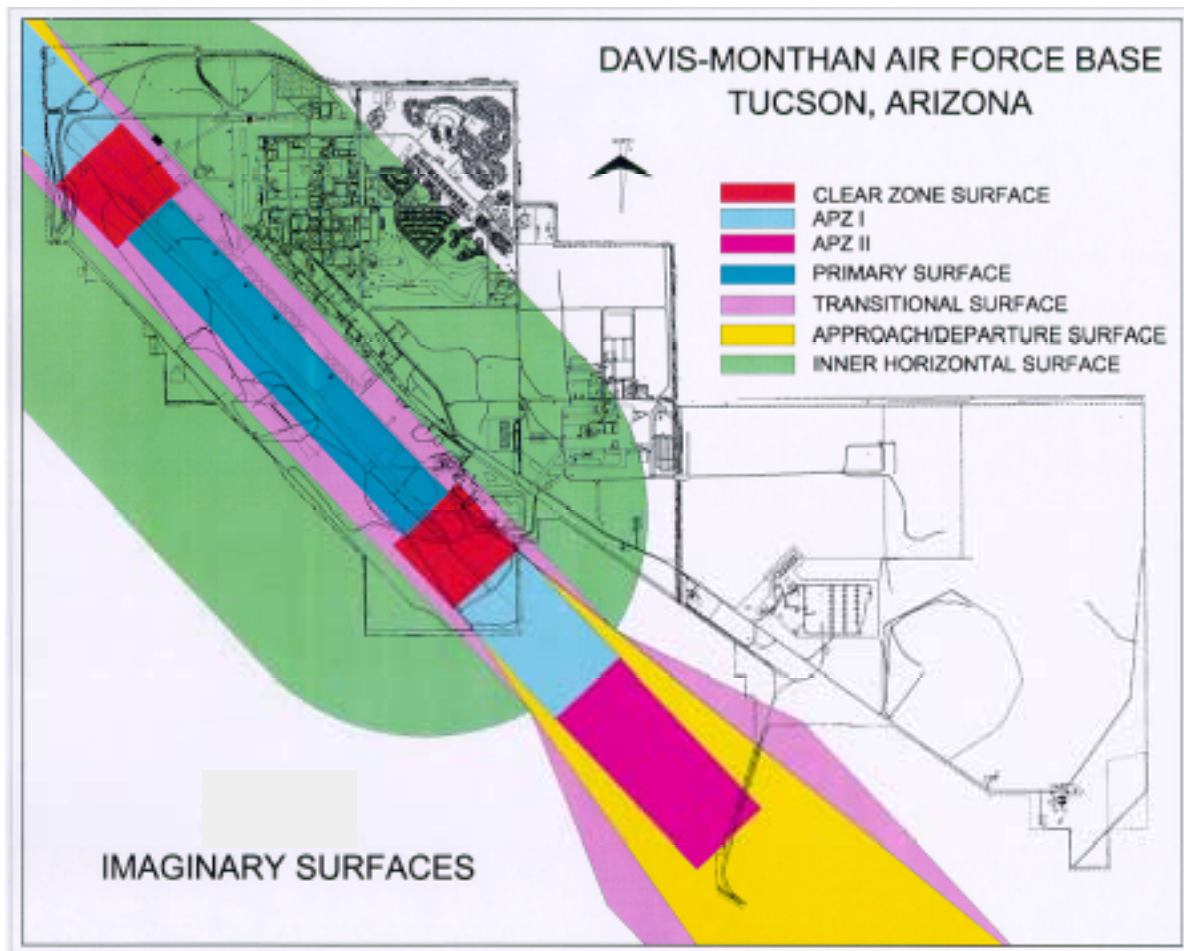


Figure 1 - Imaginary Surfaces

**Primary Surface**

**Clear Zone**

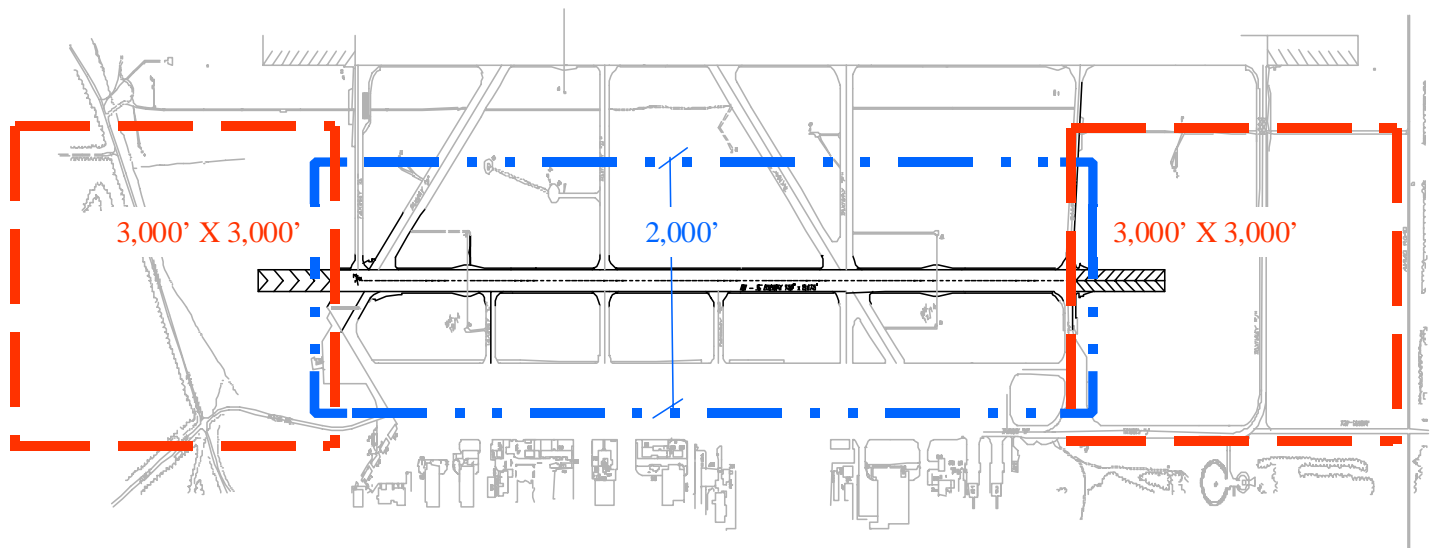


Figure 2 - Primary Surface and Clear Zone

## **HQ USAF Tasking**

From Aug – Oct 99 SAF/IG conducted a review of construction and repair projects at Misawa Air Base, Japan and completed their Report of Review (1). Their recommendations identified several weaknesses in Air Force engineering construction practices and also revealed ATCALs did not meet established frangibility requirements. The SAF/IG recommendations were as follows:

1. The Air Force adopt the FAA specifications for Low-Impact Resistant Structures as stated in FAA Advisory Circular No. 150/5345-45A
2. AF/IL ensure that all leadership within Air Force civil engineering units are familiar with, understand, and comply with airfield frangibility requirements
3. AF/SC ensure that the 38<sup>th</sup> Electronics Installation Group (EIG) brings Project Support Agreements and associated drawings into compliance with Air Force directives regarding frangibility
4. AF/SC perform a review of the process that the 38<sup>th</sup> EIG uses for installing structures in clear zones
5. AF/IL ensure that MAJCOMS identify all non-frangible structures within clear zones and make removal and replacement of those structures a priority

In Jan 00 Gen Ryan (CSAF) directed AF/IL to use the results of the IG report and expand the review to include all US Air Force bases and to emphasize compliance with frangible construction. AF/ILE led this initiative and formed a cross-functional tiger team to execute this directive. ILE specified the assessment would identify all airfield obstructions and directed a plan be developed to mitigate airfield obstructions across the Air Force. Further, the team would recommend changes to current policies and procedures to improve the current situation.

The team consisted of members from the Office of The Civil Engineer (AF/ILE), The Air Force Civil Engineer Support Agency (AFCEA - a FOA of AF/ILE), the Chief of Safety (AF/SE), the Air Force Flight Standards Agency (AFFSA - a FOA of AF/XOO) and the Air Force Communications and Information Center (AFCIC/AF/SC). The initiative began on 11 Jan 00 with representatives from several MAJCOMs, AF/XOWP (Weather), and the Air Force Center for Environmental Excellence (AFCEE).

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(1) This report is a privileged document. It will not be disseminated without the approval of the Inspector General, SAF/IG. Requests should be sent to USAF Inspector General, 1140 Air Force Pentagon, Washington DC 20330-1140

These meetings produced several items:

- Developed a tasking message from AF/CV to ALMAJCOMs requesting their support for this initiative
- Built a database format and developed guidance to collect data
- Developed a detailed memo from AF/XO, AF/SE, and AF/ILE to their counterparts at the MAJCOMs providing specific instructions for collecting airfield obstruction data
- Identified a date for a working group of experts to review data and evaluate current policy, procedures, and criteria related to airfield obstructions, construction and the annual waiver process
- Staffed and received CSAF approval of an out of cycle funding request for \$1.2M to correct Misawa's "high" risk airfield obstructions. PACAF previously funded projects to correct "critical" risk obstructions.
- Staffed and received CSAF corporate structure approval of a subsequent funding request for \$6.9M in FY 02 to correct PACAF's critical risk airfield obstructions

In May 00, the team hosted the first-ever working group consisting of 40 airfield experts from Civil Engineering, Airfield Operations, Safety, Communications, Weather, and others to review data, airfield criteria, airfield construction practices, the annual waiver process and other topics (2). Comments and suggestions from these experts are used throughout this report. Key results included:

- Identifying priority areas around the runway where obstructions presented the highest risk to airfield safety
- Clarifying and expanding waiver guidance
- Creating a more efficient process of reviewing and updating the annual waiver package
- Proposing new frangibility standards
- Adopting FAA frangibility criteria for approach lights and expanding it to include other equipment and facilities
- Identifying current technologies available to better manage the waiver program
- Developing education, training and awareness guidelines
- Improving the current waiver process by improving the communication and coordination link between functional communities

These proposals are discussed in detail in the next section. Most are in the process of being completed.

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(2) Minutes of working group are available at <http://www.afcesa.af.mil/directorate/ces/civil/airfield/airfieldspt.htm>



## SECTION 1 - CURRENT SITUATION

This section highlights findings identified during this assessment and recommends corrective actions. It begins by highlighting what the tiger team found, then restating the SAF/IG recommendations and providing the team's response.

This assessment revealed many good initiatives developed by base, MAJCOM and Air Staff level personnel to minimize the safety risks caused by airfield obstructions. For example:

- Air Traffic System Evaluation Program (ATSEP) developed by the Air Force Flight Standards Agency in 1992 created an awareness of airfield deficiencies and has done much to reduce flight safety risks across the Air Force
- Air Combat Command developed a Geographical Information System-based Airfield Obstruction Management System (AOMS) that provides real time data, pictures and project information on every airfield obstruction, greatly enhancing the ability to "manage" the airfield waiver program
- Air Force Civil Engineer Support Agency is developing a CD-ROM training program that, when completed, will provide badly needed interactive training to civil engineer, airfield management, safety personnel and others that work daily with airfield waivers and obstructions

Despite these initiatives, there are several areas needing improvement. Feedback from those involved daily in managing airfield construction indicate the need for increased awareness and oversight across the Air Force in the following areas:

- The Air Force has a number of airfield obstructions that can be mitigated with little cost
- Current processes can be improved to cultivate an atmosphere that emphasizes flight safety when constructing anything on the airfield
- Not all Commanders are as aware of the flight safety concerns related to airfield obstructions as they should be. Current processes exist that should keep commanders informed; however, they can be improved.
- Findings indicate the need for better communication and coordination among Airfield Operations, Safety, Civil Engineering and Communications at all levels - Air Staff, MAJCOM, and base

Air Force personnel recognize the need to improve existing processes. The CSAF's direction alone has done much to raise awareness of the problems and by itself has made their jobs easier. The hosting of the working group in May 00 further heightened that awareness.

## **SAF/IG Recommendations**

1. The Air Force adopt the Federal Aviation Administration (FAA) specifications for Low-Impact Resistant Structures as stated in the FAA Advisory Circular No. 150-5345-45A

**Response:** The Air Force did adopt FAA Advisory 150-5345-45A, *Lightweight Approach Light Structure*, on 17 Sep 79 when they published USAF's airfield lighting design standard, AFM 88-14, *Visual Air Navigation Facilities*. It is currently promulgated within the replacement document, AFMAN 32-1076, *Visual Air Navigation Facilities*, 1 Dec 97. However, we agree this standard should be adopted to the maximum extent practicable for other equipment, systems, and facilities, that must be located within the airfield environment. This specification is intended solely for development of approach light supports up to 40-feet in height; therefore, the scope must be expanded to cover other equipment and facilities as well. We will significantly change AFMAN 32-1123, *Airfield and Heliport Planning and Design*, to incorporate FAA language and better define frangibility requirements for the airfield environment (Attachment 1). In addition, we will institute a review process for existing and permissible deviations proposed for inclusion in AFMAN 32-1123, and consult with subject matter experts to determine whether frangibility is possible or economically feasible. Upon completion of this effort, we will add a note to each permissible deviation to indicate whether or not frangibility applies to the item(s) and if so, how to meet criteria. If it is not possible to meet the criteria, a note will be added to the siting criteria indicating such. We will also address land uses allowed within the clear zone by AFI 32-7063, *Air Installation Compatible Use Zone (AICUZ) Program*.

**OPR:** HQ AFCESA

**ECD:** May 01 to publish changes to AFMAN 32-1123

2. AF/IL ensure that all leadership within Air Force civil engineering units are familiar with, understand, and comply with airfield frangibility requirements

**Response:** HQ AFCESA will accomplish the following corrective actions.

a. Prepare a USAF/XOO/ILE policy letter requiring airfield management, safety, communications, community planners, and design engineers coordinate on any project, drawing or work request dealing with the airfield area. Civil engineer squadron personnel will verify designs meet frangibility requirements.

**OPR:** HQ AFCESA/CES

**ECD:** 8 December 00

b. A draft Civil Engineering Air Force Pamphlet, coordinated with AFFSA, on Working in the Operations Management Field will be modified to include a requirement that any work done on the airfield or having the potential to affect airfield operations will require the Airfield Manager signature on any project, drawing or work request. This requirement will also be included in AFI 32-1123.

**OPR:** HQ AFCESA/CEO

**ECD:** May 01 for AFMAN 32-1123 and Sep 01 for publishing the final pamphlet

c. HQ AFCESA has worked with AFFSA to ensure frangibility requirements are addressed within the Military Airfield Manager course that covers airfield design.

**OPR:** HQ AFCESA/CES

**ECD: Completed Jul 00:** HQ AFCESA/CESC has increased the focus on compliance with frangibility requirements during each Chief Airfield Management course briefing. Emphasis is placed on the areas that require frangible structures, how to recognize problems, and whom these problems should be identified to. One briefing is conducted for each class (about one per month).

d. Develop a CD-based training program for all civil engineer squadron personnel that work with airfield construction and will address the need to comply with frangibility requirements and other airfield criteria on all airfield projects.

**OPR:** HQ AFCESA/CES

**ECD:** Jul 01. In Jul 00 a contract was awarded (\$85K). In Sep 00 the draft narrative for the course was sent to MAJCOM CE, DO, SE, and AFFSA/XAO for review.

e. Engineering Technical Letter (ETL) 88-4, Reliability and Maintainability Design Checklist is being revised. It contains a checklist for design engineers to use to ensure all criteria and requirements have been considered. For airfields, frangibility will be added.

**OPR:** HQ AFCESA/CES

**ECD:** Unknown due to backlog of technical editing services. Checklist has been modified and is awaiting technical editing and publishing.

f. A new ETL will be developed to spell out standard criteria and provide some specific examples of approved frangible designs that comply with airfield frangibility requirements. It will be made available to all civil engineer squadrons as a standard which may be modified for site specific needs. The new ETL will be provided to the Communications Engineering Installation Group to use for equipment installation designs. As specific design applications are approved they will be added to the new ETL.

**OPR:** HQ AFCESA/CES

**ECD:** Sep 01 for the first phase -- developing generic frangible support solutions for common types of air traffic control and landing systems (ATCALs) installed in clear zones. In Sep 00 a contract was awarded (\$140K) to develop this ETL.

g. An AFCESA-Gram will be prepared to address frangibility for airfield structures. It will be targeted to all civil engineer squadron commanders, engineering and operations flight commanders, chiefs of design and maintenance engineering, engineers and community planners.

**OPR:** HQ AFCESA/CES

**ECD:** Mar 01. The A-Gram will highlight the actions we are taking as a result of this report.

3. AF/SC ensure that the 38<sup>th</sup> Electronics Installation Group (EIG) brings Project Support Agreements and associated drawings into compliance with Air Force directives regarding frangibility

**Response:** 38<sup>th</sup> EIG will accomplish the following corrective actions.

a. Review and annotate all ATCALS standard drawings to show reference to Base Civil Engineer as the OPR for frangibility design requirements for supporting structures in the clear zone.

**OPR:** 38<sup>th</sup> EIG

**ECD:** Completed Oct 00

b. Review and annotate all ATCALS standard drawings to clarify any potentially ambiguous symbols used in the drawings.

**OPR:** 38<sup>th</sup> EIG

**ECD:** Completed Oct 00

c. Drawings will also include communication specifications relevant to the support structure characteristics and provide suggested frangible support products known to be commercially available.

**OPR:** 38<sup>th</sup> EIG

**ECD:** Completed Oct 00

d. Revise the format statement presently used in PSAs to more clearly direct frangibility requirements to the Civil Engineers and will include references to specific directives. These changes will align the drawings with the standard PSA formatted statement for ATCALS and allow each document to stand alone.

**OPR:** 38<sup>th</sup> EIG

**ECD:** Completed Aug 00

4. AF/SC perform a review of the process that the 38<sup>th</sup> EIG uses for installing structures in clear zones

**Response:** 38<sup>th</sup> EIG will take the following actions to provide additional emphasis to frangibility issues:

a. The 38<sup>th</sup> EIG will notify remaining organic engineering and installation units in writing that they must continue to address the frangibility issue in PSAs and other supporting documents for all existing and new projects involving ATCALS, and that they must use the revised standard drawings.

(1) The units will be instructed to clearly identify the OPR for frangibility issues for all existing and new projects involving ATCALS.

(2) Guidance will include deferring site specific frangibility requirements to the local base CE and providing assistance to the local CE unit on any equipment adaptation issues.

**OPR:** 38<sup>th</sup> EIG

**ECD:** Completed Aug 00

b. The 38<sup>th</sup> EIG will instruct its planning and project managers in writing to ensure appropriate action agencies address frangibility issues (per regulations) whenever they (EIG planners and project managers) are involved in or review contract products initiated by the 38<sup>th</sup>

EIG or other organizations (bases, MAJCOMs, etc) for the acquisition or implementation (installation, relocation, removal, upgrades) of ATCALS.

**OPR:** 38<sup>th</sup> EIG

**ECD:** Completed Aug 00

c. The 38<sup>th</sup> EIG will revise its project engineering regulation to include direction and reference to Civil Engineering's AFIs which identify the requirements for frangibility of ATCALS in clear zones. This revision will identify the Base CE as OPR and require organic engineering and installation teams (738<sup>th</sup> EIS and ANG) to coordinate appropriately with CE units when performing any ATCALS related installations.

**OPR:** 38<sup>th</sup> EIG

**ECD:** Completed Sep 00

d. The 38<sup>th</sup> EIG will work with the AF Civil Engineering Support Agency to obtain generic frangible support solutions for common types of ATCALS installed in clear zones. The 38<sup>th</sup> EIG will supply AFCESA with copies of PSAs and associated drawings for use by an architectural and engineering firm to develop appropriate designs for frangible supports. This effort will provide a ready source of engineering solutions for use by BCEs and help institutionalize awareness of frangibility requirements.

**OCR:** 38<sup>th</sup> EIG and HQ AFCESA/CES

**ECD:** Sep 01. This recommendation is included in the response to SAF/IG recommendation 2f.

5. AF/IL ensure that MAJCOMS identify all non-frangible structures within clear zones and make removal and replacement of those structures a priority

**Response:** See Section 2 - Funding Strategy

## **Additional Findings and Recommendations**

These findings and recommendations go beyond those of the SAF/IG's recommendations and address project siting, approval and procedural deficiencies inherent in the process of constructing facilities near the airfield.

**Finding 1:** Waiver processing roles and responsibilities are deficient. The current process omits key functions from the coordination process. Obstruction mitigation projects receive low priority for completion because of a lack of a program champion. Obstructions can take many forms: trees, ATCALS, facilities, infrastructure, weather instruments, natural surfaces, etc. These are dissimilar items that do not fall under one functional community. Flying operations are affected by obstructions. The Airfield Manager is responsible for managing the airfield to support flying operations. Civil Engineering is responsible for operation and maintenance of base infrastructure. Communications is responsible for ATCALS and airfield weather equipment maintenance. DO is responsible for ATCALS operations. Weather is responsible for weather equipment operations. Safety is responsible for overseeing risk assessment and mishap prevention programs. All have a hand in ensuring obstructions are mitigated.

### **Recommendations:**

- a. Modify existing waiver processing procedures to include Ground Safety, Logistics, Terminal Approach and Departure Procedures (TERPS) and Communications
- b. Establish clear lines of responsibility

**OPR:** HQ AFCESA

**ECD:** May 01 to publish changes to AFMAN 32-1123

**\*\*Note** - under Current Initiatives later in this section, PACAF's #1 reason for improved awareness of impacts of obstructions on flight safety is due to the creation of MAJCOM and base cross functional working groups that bring synergy to this issue.

**Finding 2:** Waiver approval procedures are deficient. The waiver process lacks visibility at the commander level. Waiver signature responsibility at installations rests with the Base Civil Engineer and approval rests with MAJCOM/CE. Approval should be at level "higher" than MAJCOM/CE.

### **Recommendations:**

- a. Change policy to require all requests for waivers be signed by the Installation Commander
- b. Change policy to require all waivers be approved at the MAJCOM by the Vice Commander.

**OPR:** HQ AFCESA

**ECD:** May 01 to publish changes to AFMAN 32-1123

**\*\*Note** - under Current Initiatives later in this section, a Jan 99 AF/XOO Conference concluded with the recommendation that required Installation Commanders sign all waiver requests. This takes that one step further and brings the MAJCOM Vice Commander into the process. This

recommendation, together with recommendations to Finding 3 will increase commanders' visibility.

**Finding 3:** Current processes exist to keep commanders informed; however, they require improvement. The Airfield Operations Board (AOB) and Facilities Utilization Board (FUB) have established agendas that should be used to highlight the annual waiver program.

- The AOB is a forum for discussing, updating, and tracking various activities in support of the wing flying mission. It is typically chaired by the Operations Group Commander and meets once per quarter. Units represented include: flying organizations, Stan-Eval, Flight Safety, ATC operations, Airfield Management, TERPS, communication and civil engineer squadrons, FAA and/or host nation ATC facilities, OSS/CC, base weather, aero club manager (if applicable), and an airspace manager. The agenda includes tracking and reporting items such as number and status of permanent/temporary airfield waivers, condition of airfield pavements, trend data collected by reports and surveys.

- The FUB is a forum for establishing project priorities and approving facility sitings. It is typically chaired by the Installation Commander, and meets once per quarter. Group commanders are members of the FUB and squadron commanders typically attend. The Base Civil Engineer manages this program for the Installation Commander.

**Recommendations:**

- a. Emphasize the use of the AOB to bring visibility to airfield obstructions and to establish priorities for and track progress in completing airfield obstruction mitigation projects. Results of the AOB can be used to update the Installation Commander and lobby for support for projects at the FUB.

**OPR:** AF/XO

**ECD:** TBD

- b. Emphasize the use of the FUB to bring visibility to mitigation projects requiring funding and as a forum to approve the annual waiver submission.

**OPR:** AF/ILE

**ECD:** TBD

**Finding 4:** Compliance with current airfield criteria is difficult due to the lack of available real estate to site new facilities and funding constraints. Nearly all Air Force bases were constructed before the primary surface was expanded in 1964 and the clear zone was expanded in 1974. These expansions allowed many facilities - primarily operations support facilities - within the new boundaries to remain as exemptions. Even though these facilities are exempt from existing standards, renovation, expansion, and new additions or development of vacant real estate between these facilities generate new waiver requests each time a mission change creates the need for new flightline facilities. Strict application of current criteria would require demolition and replacement of many structures although it is not feasible due to lack of real estate and funding.

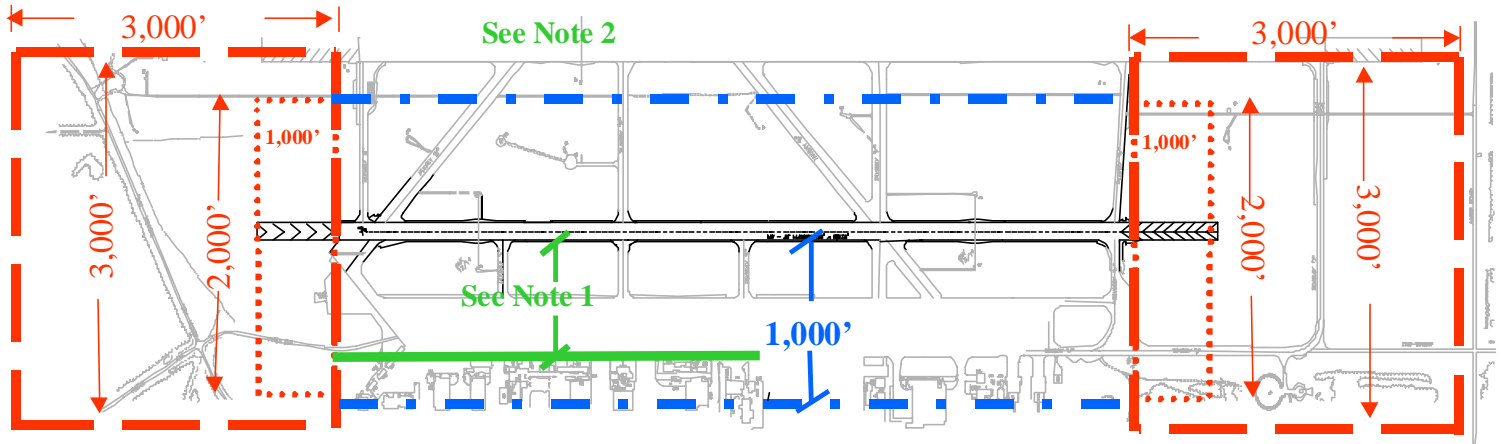
**Recommendation:** Clarify AFMAN 32-1123 to better explain the policy for exempt facilities, and modify the policy for new construction and land use to allow continued but controlled development without waiver. This will significantly reduce the administrative burden imposed by the airfield waiver program without increasing risk to flight or ground safety. It will allow continued growth at bases with land constraints and will continue to protect existing airspace. It can be accomplished by requiring each base establish a Building Restriction Line similar to that required by the FAA (See Figure 3). This area, with both lateral and elevation control, would be established based on the predominant outline and profile of existing facilities, excluding those that impact the Terminal Approach and Departure Procedures (TERPS) criteria. The clear zone would also be excluded to comply with Air Force policy for land use within the area identified as having the highest potential for flight mishaps. Further development of the area between the building restriction line and the existing imaginary surfaces will be controlled by limiting development to the category codes of the existing facilities. The last step in this process will be to perform an operational risk management (ORM) assessment of the airfield. This will provide a benchmark for evaluating proposed future mission changes and further development of the base. Changes will be incorporated into AFI 32-7062, *Air Force Comprehensive Planning*.

**OPR:** HQ AFCEA

**ECD:** The USAF/XOO/ILE Policy Letter recommended under SAF/IG ROR Recommendation 2a will address implementation of the Building Restriction Line. The policy will also be included in Change 1 to AFMAN 32-1123. The draft policy letter will be provided for signature by 8 Dec 00 and Change 1 to AFMAN 32-1123 will be completed in May 01.



## Building Restriction Line (BRL)



**Note 1.** Distance varies. BRL to be established at the predominant line of obstructions. Establishes both lateral and elevation controls for new construction. Exclusive of Clear Zones and objects that already affect TERPS.

**Note 2.** No BRL established on undeveloped land. Standard USAF criteria apply for new construction.

### Legend

**Clear Zone**

**Graded Area of Clear Zone**

**Building Restriction Line**

**Primary Surface**

Figure 3 - Building Restriction Line

**Finding 5:** Existing directives are numerous and confusing. Policies and procedures for obstruction management are lacking. Definitions regarding types of waivers, frangibility, exemptions, permissible deviations can be improved. Coordination with the Communications community is lacking.

**Recommendation:** Modify existing instructions and/or develop a new Air Force Instruction that provides better, clearer guidance for managing obstructions to limit airfield encroachment.

**OPR:** HQ AFCESA

**ECD:** May 01 to publish changes to AFMAN 32-1123

**Finding 6:** Lack of education and awareness of airfield construction criteria by base and MAJCOM personnel. No formal training on airfield design criteria exists for key personnel except the Military Airfield Manager course at Keesler.

**Recommendation:**

a. Improve the knowledge of the CE designers and community planners and the airfield managers on airfield criteria.

b. Develop proficiency training for technical personnel from CE, DO/XO, SE, SC.

**OPR:** HQ AFCESA

**ECD:** Jul 01. These recommendations are included in the response to SAF/IG recommendations 2c and 2d.

**Finding 7:** There is no standardized format for collecting and reporting annual waiver data. Program oversight is hampered because of the inability to monitor progress across MAJCOMs and installations. Current initiatives exist to efficiently and effectively organize, maintain, and manage airfield obstruction data using the latest in database and GIS technology.

**Recommendations:**

a. Establish standards (and perhaps a standardized system) for collecting, and reporting Air Force-wide airfield waiver data.

b. Use the database format developed for this initiative as the baseline and make necessary enhancements to improve data tracking and reporting

c. Endorse Air Combat Command's *Airfield Obstructions Management System* as the standard for all MAJCOMs. Note - HQ PACAF has already done so and has developed enhancements that should also be considered for incorporation. These systems provide a versatile database for review and action, allow bases to view obstructions via a picture, generate automated waiver requests, document maps, etc. OPR: AF/ILE, OCRs: AF/XO, AF/ILE, AF/SE

**OPR:** HQ AFCESA

**ECD:** The Airfield Obstruction database created for the data collection effort phase of this project will be updated and provided on the AFCESA web page for use by all bases. The ACC Airfield Obstruction Management System has been shared with the other commands and the program will be modified for compatibility with the AFCESA Airfield Obstruction database. The ACC Program Manager has tentatively scheduled a workshop to incorporate these changes

in the base program in Jan 01. Changes to AFMAN 32-1123 pertaining to collecting and reporting waiver data will be complete in May 01.

**Finding 8:** Policy for application of USAF airfield clear air space criteria in overseas locations is vague and confusing. AFMAN 32-1123 can be interpreted to allow MAJCOMs to elect to use International Civil Aviation Organization (ICAO) or Federal Aviation Administration (FAA) criteria in lieu of Air Force criteria. (\*\*Note - clear air space criteria differs from the FAA frangibility design criteria the Air Force adopted as discussed in SAF/IG recommendation 1). Paragraph 1.2 was written to allow for other host nation criteria to apply only if written agreements exist between the host nation and the DoD, otherwise Air Force criteria should pertain to all because FAA and ICAO clear air space criteria are not designed to accommodate military operations.

**Recommendation:** Modify AFMAN 32-1123, paragraph 1.2 to clarify the intent as indicated above.

**OPR:** HQ AFCEA

**ECD:** May 01 to publish changes to AFMAN 32-1123

## **Current Initiatives**

**Air Traffic System Evaluation Program (ATSEP).** The Air Force Flight Standards Agency is Program Manager for ATSEP. ATSEP evaluates the ability of the air traffic system to meet standards and operational requirements of civil and military users. All USAF, USAF Reserve, Air National Guard and USAF installations not on US territory are subject to the program. An evaluation is conducted at each location at least once every 24 months. Team composition (usually MAJCOM functional representative with Air Flight Standards Agency augmentation) and scope of the evaluation depend primarily on the level of USAF functional responsibility within that air traffic system. The final report is distributed to WG/CC, MAJCOM/DO/SC/CE, AF/XOOR and AFSC/SEFO. Airfield and airspace waivers to include violations to clearance requirements such as airfield obstructions are part of the evaluation process. The team members review waiver packages and conduct airfield inspections to identify systemic problems within the waiver process. Not all waivers and obstructions are reviewed and evaluated, only a sampling. Airfield/airspace obstruction waivers have been a Special Interest Item (SII) of ATSEP since 1998.

**Air Combat Command Airfield Obstruction Management System.** This database is Geographical Information System (GIS) - based and allows the input of obstruction data, photographs, maps, descriptions and mitigation project information data. ACC will modify their system to incorporate fields in the airfield obstruction database developed for this initiative to allow them to better manage airfield obstructions. This database also allows the CE community planner to streamline the waiver review process, and provides a visual of each obstruction upon demand, thereby eliminating the need to return to the field. PACAF has adopted this system for their own airfield obstruction mitigation effort.

**Pacific Air Forces Lessons Learned.** PACAF has focused on reducing and mitigating airfield waivers and obstructions for the past two years. Highlights of their efforts are included below.

- Teamwork among DO, SE, and CE at the MAJCOM was the key to getting effective results quickly.
- Due to their effective teamwork, they elevated awareness of problems associated with airfield obstructions to all installation commanders. For example, new commanders get briefed by the CV, DO, CE, and SE during their orientation.
- Created PACAF Sup 1 to AFMAN 32-1123, *Airfield and Heliport Planning and Design*, to formalize their commitment to mitigating airfield obstructions. Specifically it:
  - Describes how to submit airfield waivers
  - Clarifies how and when to submit the annual airfield/airspace base waiver plan
  - Establishes an airfield working group
  - Establishes a training program
- Established a mobile training team to train those CE, SE, and DO people that design projects and manage airfield waivers.
- Adopted ACC's airfield management system and modified it to fit their desires

**HQ AF/XOO Conference, Jan 99.** HQ AFFSA worked with HQ AFCESA to make the waiver process more stringent, consolidate CE guidance, reduce airfield waivers/obstructions.

Initiatives included:

- Requiring the Wing CC signature on all waiver requests
- Formalizing certification of AF standards and criteria
- Consolidating CE guidance
- Developing an AF standardized inspection checklist. Use of this checklist will aid in determining if the airfield is in compliance with AF standards and criteria

**The National Imagery and Mapping Agency (NIMA) Airfield Initiative Program.** A cooperative effort between AFFSA, NIMA, the FAA and civil aviation agencies to produce the safest possible terminal procedures for some of the world's busiest airports.

More than 900 military and civil airports will be surveyed over the next 3 years. The project will identify and precisely locate obstacles in arrival and departure zones. The data obtained in this project will provide the information needed to design terminal procedures for non-precision as well as precision approaches and for GPS-guided approaches as technology improves.

NIMA will use the information gathered during the survey to build a worldwide reference database. In addition, Civil Engineers can receive data to validate their base drawings. The information will also be available to airfield management and other agencies.

## **SECTION 2 - FUNDING STRATEGY**

This section explains the process used to establish a funding strategy starting with describing the data collection process, then determining priorities, followed by a recommended funding strategy. It includes figures and tables that are provided to support the decisions of the tiger team

### **Collection of Data**

The collection of airfield obstructions and costs has been an extensive effort that has provided much insight into the magnitude of the problems facing the Air Force. Starting with the initial data call guidelines in February, there has been considerable effort given to collect the right data in the right format. The following objectives were the primary considerations for the data collected:

- Convey the importance of this data call from the top down
- Require MAJCOMs to review and coordinate data
- Emphasize the focus on all airfield obstructions, define obstructions
- Use existing annual airfield waiver data and cross functional members to identify, assess for operational risk management (ORM), prioritize, and record
- Develop application to allow easy manipulation and review by MAJCOMs and bases
- Maximize the use of pull down menus to facilitate data analysis
- Use lessons learned from PACAF's recent endeavor
- Use the internet to facilitate access to the database and communicate with the field

Bases and MAJCOMs initially started only with data in their annual airfield waiver submissions. An ideal scenario would bring cross functional teams together, brush up on ORM principles and techniques, review each item in their annual waiver submissions, assign an ORM ranking (Extreme, High, Medium or Low) and provide a cost estimate to mitigate. Unfortunately, this was not the scenario in most cases and underscores the need for more cross functional participation in this program in order to make a difference. Prior to the working group in May, MAJCOM representatives were asked to analyze their obstructions and report their findings to the group. Data was consolidated and initial reports generated listing obstructions by MAJCOM by base.

### **Determining Priority Areas**

Upon review of the data, it was apparent there was a lack of consistency in the ORM ratings (one base's "Extreme" was another's "Low"). As a result, the tiger team determined prioritization by risk, using PACAF's model, was a better way to determine an equitable Air Force prioritization strategy. Air Force priorities for funding are based on distance from the runway. Beyond that, MAJCOM/base priorities can use the ORM ratings to determine integrated priorities. Using flight safety data (See Section 3, Flight Safety History and Risk Assessment) the tiger team determined the size of priority areas based on their location relative to the runway. Existing data shows a direct correlation between accident frequency and distance

from the runway. This holds true for distance from the centerline and distance from the end of runway. Using this rationale the team selected three areas that emanate concentrically outward from the runway as priority risk areas. Figure 4 shows the Air Force and PACAF priority risk areas. The Air Force priority areas are slightly larger than the PACAF model and were based on actual flight mishap data.

The Air Force “critical-risk” (priority area 1) dimensions are 350 feet from runway centerline and 2000 feet from the threshold in the clear zone.

- 250 feet from the centerline is approximately coincident with the minimum set-back required for aircraft arresting systems and essential ATCALs. It is equivalent to the FAA’s Runway Safety Area for the most demanding aircraft. In addition Air Force and FAA flight mishap data show a predominance of accidents within 250 from the centerline. The additional 100 feet account for varying widths of runways plus a margin of safety.

- The 2000 feet in the clear zone again was supported by mishap data. Air Force criteria requires the first 1000 feet in the clear zone (also known as the graded area) to contain zero vertical obstructions. The remaining 2000 feet in the clear zone require frangibility to be incorporated into allowed structures to the maximum extent practicable.

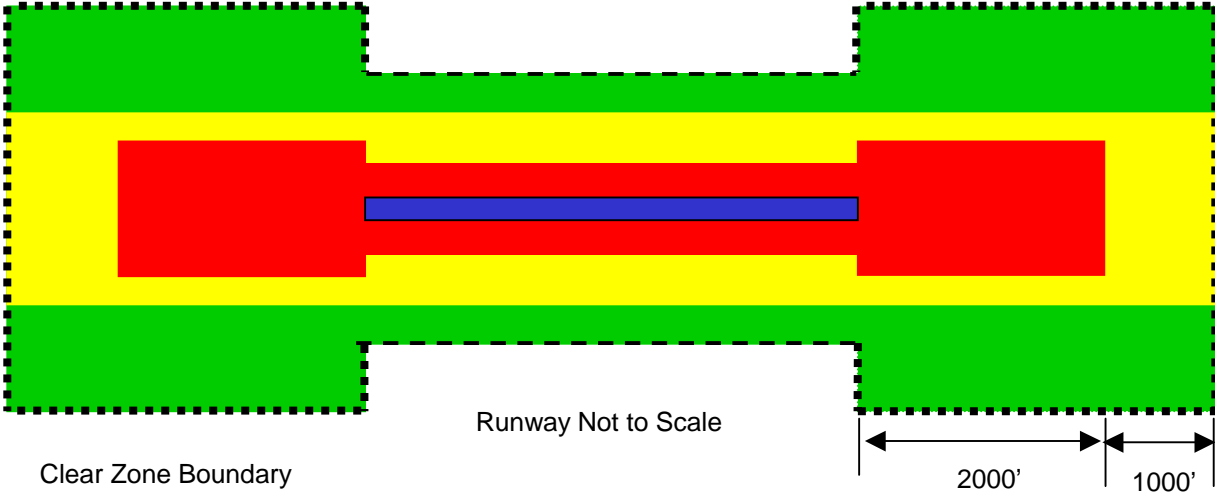
With the AF priority areas determined, reports were generated at the working group for each command representative to review and validate the information, paying particular attention to the accuracy of project costs as reflected on the report. MAJCOM representatives were given an additional 30 days to scrub the data and provide corrections to the project manager at AFCESA. The sheer volume of data mandated several reviews and queries in order to establish a credible baseline.

Table 5 shows Air Force requirements. Please note the bottom line totals: nearly 2000 obstructions, a \$1.1 billion dollar bill. For critical obstructions, those numbers are 519 obstructions and a \$122 million dollar bill. Table 6 shows MAJCOM requirements.

## **Recommendation**

A recommended goal for mitigating all “critical-risk” airfield obstructions by 2010 is both achievable and reasonable. It meets the SAF/IG’s finding: “...Ensure MAJCOMs identify non-frangible structures within clear zones and make removal and replacement of those a priority,” and fully supports the CSAF’s direction: “...ensure compliance with frangible construction.” To achieve this, the tiger team recommends funding for Priority Area 1 requirements in the 03 APOM with extended funding throughout the FYDP. FY03 would be a ramp up year totaling \$15M with follow on funding totaling \$10M -15M for each remaining year in the FYDP. Additional funding will be required beyond that to fully fund removal of obstructions that pose a critical risk to flight safety. Clearly, as Tables 5 and 6 show, the overall requirement to mitigate obstructions is significant. Every MAJCOM has critical obstructions and it is evident there is much more that can and should be done in the high and medium risk priority areas. However, in order to keep the focus on the most critical needs first, the goal remains one that is achievable and reasonable. Table 7 shows a chart depicting FY 03-10 funding by type.

## AIR FORCE PRIORITY RISK AREAS



- **Priority Area 1** - 350' from r/w center line and 500' in CZ, 2000' beyond threshold
- **Priority Area 2** - 350'-700' from r/w centerline, 500'-700' in CZ; 2000' to 3000' in CZ (remainder of CZ longitudinally)
- **Priority Area 3** - 700-1000' from r/w centerline and 700-1500' in CZ (remainder of CZ laterally)

## PACAF PRIORITY RISK AREAS



- **Priority Area 1** - 325' (approx) from r/w centerline, 2000' beyond threshold in CZ
- **Priority Area 2** - 325'-575' from r/w centerline, 2000'-2500' beyond threshold in CZ
- **Priority Area 3** - 575-825' from r/w center line, 2500'-3000' beyond threshold in CZ

Figure 4 - Air Force & PACAF Priority Risk Areas



**AF TOTALS - OBSTRUCTIONS AND PROJECT COSTS  
BY PRIORITY AREA, ORM RATINGS AND FUNDING CATEGORY**

<u>ORM Ratings</u>	<u>Obstructions</u>	<u>RPM \$K</u>	<u>MILCON \$K</u>	<u>3080 \$K</u>	<u>Totals \$K</u>
<b><u>AF Totals Priority Area 1</u></b>					
Extreme	58	3,878	6,986	12	<b>10,876</b>
High	138	8,128	19,500	42	<b>27,670</b>
Medium	108	5,366	51,210	0	<b>56,576</b>
Low	215	10,626	15,578	383	<b>26,587</b>
<b>Total</b>	<b>519</b>	<b>27,998</b>	<b>93,274</b>	<b>440</b>	<b>121,709</b>
<b><u>AF Totals Priority Area 2</u></b>					
Extreme	7	330	0	357	<b>687</b>
High	72	13,469	1,750	1,106	<b>16,325</b>
Medium	176	20,132	71,136	3	<b>91,271</b>
Low	313	14,358	35,862	50	<b>50,270</b>
<b>Total</b>	<b>568</b>	<b>48,289</b>	<b>108,748</b>	<b>1,516</b>	<b>158,553</b>
<b><u>AF Totals Priority Area 3</u></b>					
Extreme	6	620	0	0	<b>620</b>
High	54	8,046	119,650	0	<b>127,696</b>
Medium	243	43,774	204,819	600	<b>249,193</b>
Low	584	61,787	306,097	81	<b>367,965</b>
<b>Total</b>	<b>887</b>	<b>114,227</b>	<b>630,566</b>	<b>681</b>	<b>745,474</b>
<b><u>AF Totals All Areas</u></b>					
Extreme	71	4,828	6,986	369	<b>12,183</b>
High	264	29,643	140,900	1,148	<b>171,691</b>
Medium	527	69,272	327,165	603	<b>397,040</b>
Low	1,112	86,771	357,537	514	<b>444,822</b>
<b>Total</b>	<b>1,974</b>	<b>190,514</b>	<b>832,588</b>	<b>2,634</b>	<b>1,025,736</b>

Table 5 - Air Force Total Obstruction Mitigation Project Costs

## MAJCOM TOTALS - OBSTRUCTIONS AND PROJECT COSTS BY PRIORITY AREA AND FUNDING CATEGORY

<u>MAJCOM</u>	<u>Priority Area</u>	<u>Obstructions</u>	<u>RPM \$K</u>	<u>MILCON \$K</u>	<u>3080 \$K</u>	<u>Total</u>
<b>ACC (Number of Bases = 20 )</b>						
	PA1	166	10,175	70,710	24	80,909
	PA2	176	26,163	57,829	1,009	85,001
	PA3	367	47,060	395,328	606	442,994
	<b>Total</b>	<b>709</b>	<b>83,398</b>	<b>523,867</b>	<b>1,639</b>	<b>608,904</b>
<b>AETC (Number of Bases = 8)</b>						
	PA1	15	1,096	0	0	1,096
	PA2	1	50	0	0	50
	<b>Total</b>	<b>16</b>	<b>1,146</b>	<b>0</b>	<b>0</b>	<b>1,146</b>
<b>AFMC (Number of Bases = 6 (No report from Eglin)</b>						
	PA1	56	2,019	4,200	200	6,419
	PA2	111	3,023	12,599	0	15,622
	PA3	220	29,254	103,538	0	132,792
	<b>Total</b>	<b>387</b>	<b>34,296</b>	<b>120,337</b>	<b>200</b>	<b>154,833</b>
<b>AFRC (Number of Bases = 4)</b>						
	PA1	7	75	0	0	75
	PA2	5	761	0	0	761
	PA3	17	5,202	2,000	0	7,202
	<b>Total</b>	<b>29</b>	<b>6,038</b>	<b>2,000</b>	<b>0</b>	<b>8,038</b>
<b>AFSOC (Number of Bases = 1)</b>						
	PA1	1	0	730	0	730
	PA2	1	875	0	0	875
	PA3	1	200	0	0	200
	<b>Total</b>	<b>3</b>	<b>1,075</b>	<b>730</b>	<b>0</b>	<b>1,805</b>
<b>AFSPC (Number of Bases = 5)</b>						
	PA1	2	115	0	0	115
	PA2	5	958	0	0	958
	PA3	10	2,542	8,300	0	10,842
	<b>Total</b>	<b>17</b>	<b>3,615</b>	<b>8,300</b>	<b>0</b>	<b>11,915</b>
<b>AMC (Number of Bases = 11 )</b>						
	PA1	18	549	0	0	549
	PA2	46	3,219	0	507	3,726
	PA3	30	3,833	3,000	75	6,908
	<b>Total</b>	<b>94</b>	<b>7,601</b>	<b>3,000</b>	<b>582</b>	<b>11,183</b>
<b>ANG (Number of Bases = 9)</b>						
	PA1	4	3,901	0	0	3,901
	PA2	10	507	800	0	1,307
	PA3	9	2,430	16,300	0	18,730
	<b>Total</b>	<b>23</b>	<b>6,838</b>	<b>17,100</b>	<b>0</b>	<b>23,938</b>

<u>MAJCOM</u>	<u>Priority Area</u>	<u>Obstructions</u>	<u>RPM (\$000)</u>	<u>MILCON (\$000)</u>	<u>3080 (\$000)</u>	<u>Total</u>
<b>PACAF (Number of Bases = 10 (611 also reported for 7 outlying airfields in AK))</b>						
	<b>PA1</b>	164	7,002	640	0	7,642
	<b>PA2</b>	120	6,534	120	0	6,654
	<b>PA3</b>	132	14,024	4,230	0	18,254
	<b>Total</b>	416	27,560	4,990	0	<b>32,550</b>
<b>USAF (Number of Bases = 1)</b>						
	<b>PA1</b>	11	356	6,986	0	7,342
	<b>PA2</b>	2	20	0	0	20
	<b>PA3</b>	1	0	3,000	0	3,000
	<b>Total</b>	14	376	9,986	0	<b>10,362</b>
<b>USAFE (Number of Bases = 9)</b>						
	<b>PA1</b>	75	2,710	10,008	213	12,931
	<b>PA2</b>	91	6,179	37,400	0	43,579
	<b>PA3</b>	100	9,682	94,870	0	104,552
	<b>Total</b>	266	18,571	142,278	213	<b>161,062</b>

Table 6- MAJCOM Obstruction Mitigation Costs

## FUNDING STRATEGY

<b>\$M</b>	<b>FY03</b>	<b>FY04</b>	<b>FY05</b>	<b>FY06</b>	<b>FY07</b>	<b>FY08</b>	<b>FY09</b>	<b>FY10</b>	<b>Totals</b>
RPM	14.0	4.0	1.5	1.5	3.0	0	4.0	0	<b>28.0</b>
MILCON	1.0	10.9	13.0	13.0	12.0	20.0	8.4	15.0	<b>93.3</b>
3080	0.2	0.2	0	0	0	0	0	0	<b>0.4</b>
<b>Totals:</b>	<b>15.2</b>	<b>15.1</b>	<b>14.5</b>	<b>14.5</b>	<b>15.0</b>	<b>20.0</b>	<b>12.4</b>	<b>15.0</b>	<b>121.7</b>

Table 7- Funding by Type/by Year

## SECTION 3 - BACKGROUND

### The Airfield Environment

The airfield environment consists of a number of surfaces - actual and imaginary - that are designed to define the obstacle free airspace around the airfield. These areas include the following surfaces: primary, clear zone, approach-departure, inner horizontal, conical, outer-horizontal and transitional. Each of these surfaces has criteria or standards that must be met to provide the maximum protection for aircraft operations. All of these surfaces are not horizontal surfaces on the ground, many are three dimensional (Figure 8). Obstructions within these surfaces may or may not be an actual hazard. Keeping these surfaces completely clear is preferred, but is not always practical. If it is not feasible to remove or lower intrusions in these surfaces (mountain, building or TV tower) the obstruction must be marked and lighted according to AF standards.

In 1964 and again in 1974, Air Force flight and ground safety initiatives expanded the primary surface and clear zone, enlarging the protected airspace surrounding the airfield. The purpose of these expansions was to ensure new construction would be sited a safe distance from the runway. The objective was primarily to improve the safety of those on the ground with a collateral benefit of improving flight safety. Existing facilities in these zones were “exempt” (grandfathered) from the new criteria if their continued use would not impair operational efficiency and safety. When existing facilities were modified, construction would conform to the new standards if it were feasible to do so. Recognizing Installation Commanders need to bed down new missions (construct new facilities) on their bases, a policy was developed to allow them to request waivers to the new expanded criteria where no reasonable alternative existed. As a result, we have a situation today where in order to site new facilities among existing “exempt” structures a waiver is required. This situation prevents total compliance with the expanded criteria because it is unlikely these exempt structures will ever be demolished or replaced.



## **Flight Safety History and Risk Assessment**

Airfield criteria to ensure sustained, safe, economical, and efficient aircraft operations and aviation support facilities have been in place for more than 40 years. For a variety of reasons (reduced global conflict, new technology, better training, and increased emphasis on safety, to name a few) Class A incidents have reduced over the years (Figure 9). Focusing on the immediate airfield environment, there were 106 mishaps (Class A through Class C) involving obstructions from 1977-1999. Of those, only five were flying mishaps and just two occurred on Air Force airfields where we may have had some control. The rest of the 106 involved taxi accidents or hitting animals on the runway.

To help assess risk and develop a funding strategy, mishap data from several sources was examined. A study of clear zone mishaps was completed in 1999 that identified 207 Class A mishaps occurring between 1984 and 1998 within 10 nautical miles of Air Force bases. Of those, 96 mishaps were plotted (Figure 10) and this data can be used to show potential locations where future mishaps are most likely to occur. The remainder were not plotted because they fell outside the immediate area of the airfield. To fill in accident information in the immediate runway environment, the team also looked at Federal Aviation Administration (FAA) accident studies. In 1978, the FAA conducted a study of accident locations on civil airport runways using several years worth of data from the Airline Pilot Association (Figure 11). The purpose of this study was to determine the best location for siting airport rescue and firefighting stations. The FAA study, used in conjunction with our own data, confirms the appropriateness of the 1000' length of the AF graded area, as well as the need to protect the 3000' length of the clear zone.

All data indicate mishaps occur more frequently the closer they are to the runway. This holds true for distance from the centerline and distance from the end of runway. Using this rationale the team selected three areas that emanate concentrically outward from the runway as priority areas or risk zones. See Section 2 - Obstruction Mitigation Data and Project Costs.

This data indicates the probability of a mishap being caused by an obstruction is low, though an obstruction will exacerbate the severity of the mishap. It is this reason why the Air Force needs to make frangible - where they can - those items that must remain in the close proximity of the airfield and remove those that are unneeded.

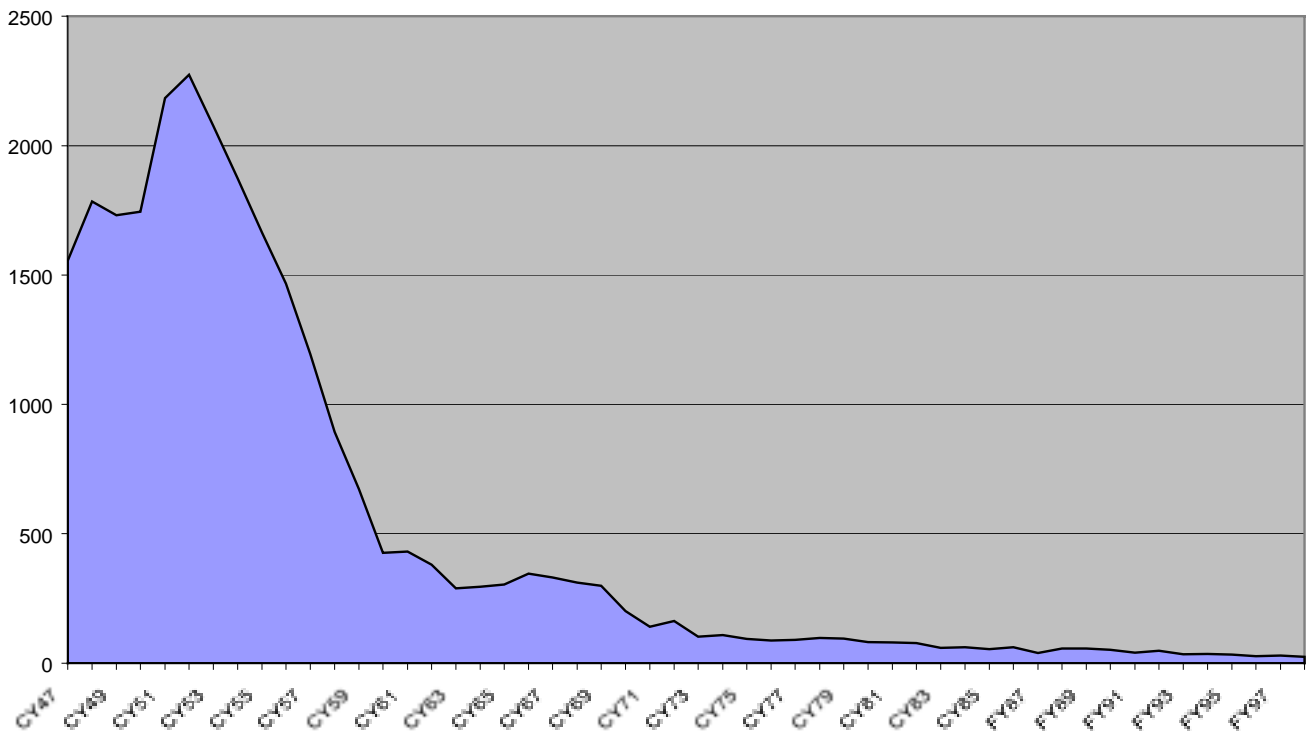


Figure 9 - Class A Mishaps  
Source: Air Force Safety Center, Kirtland AFB NM



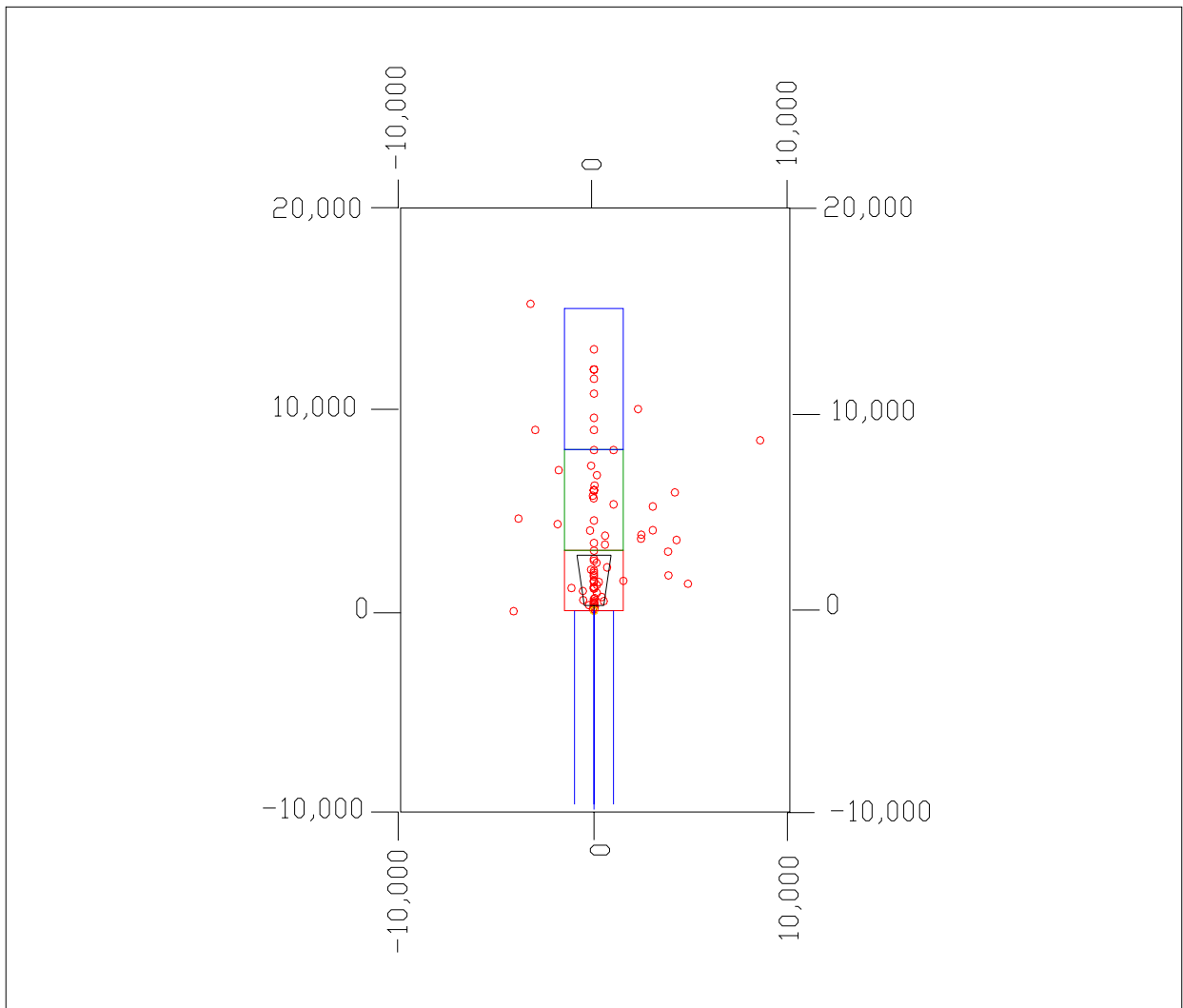
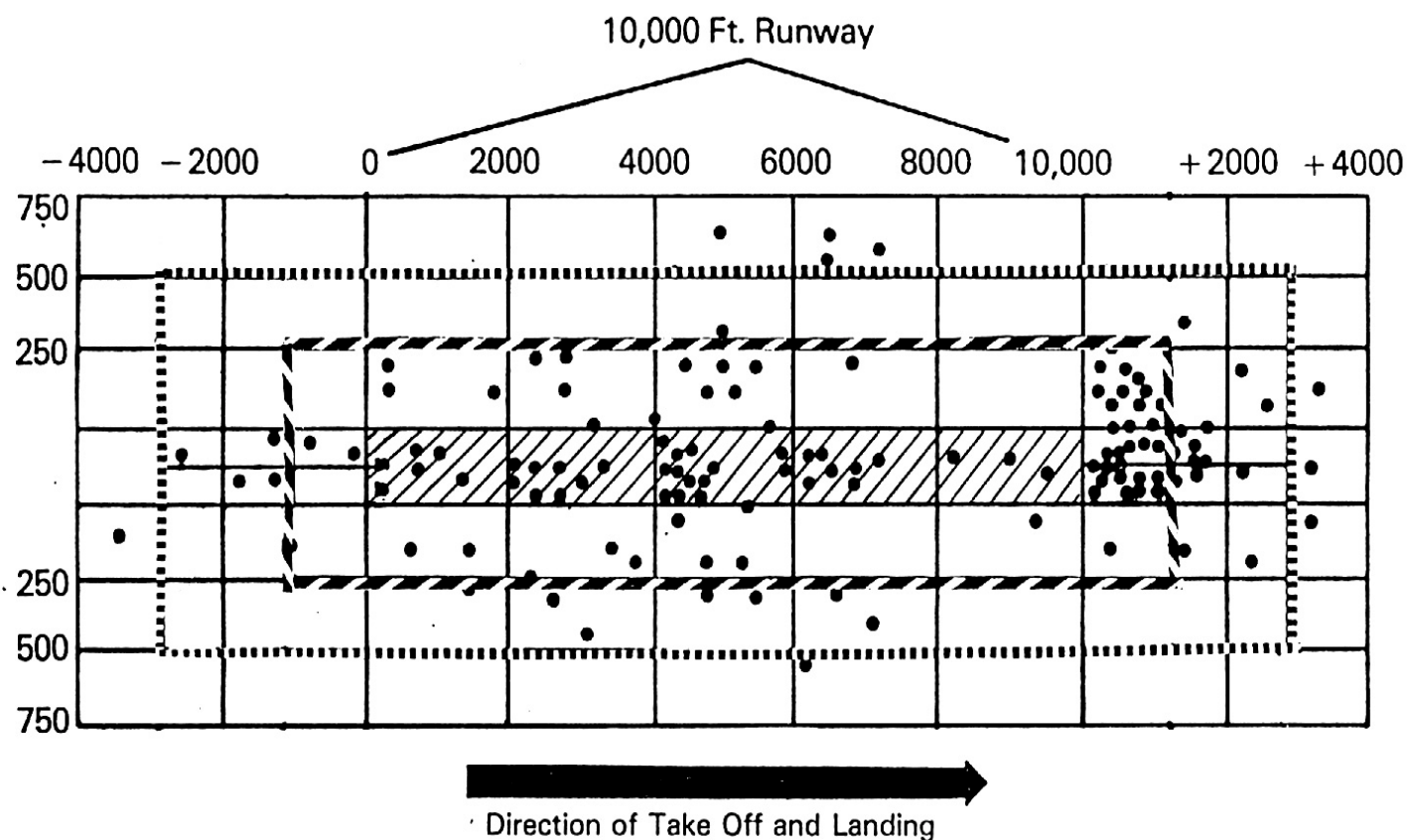


Figure 10 - Clear Zone Study , Class A Mishaps Within 10nm of Airfield  
Source: 1984-1998 Class A Mishap Reports - Various  
Air Force Safety Center, Kirtland AFB NM



Accident Data Source:  
ALPA Accident Data Forms  
Thru January 1978)

Runway  
\*\* AC 150/5300-12 - Runway Safety Area  
\* NFPA 402 - Critical RFF Access Area  
(NOT TO SCALE)



Figure 11 – FAA Accident Site Distribution

## Attachment 1

### Changes to AFMAN 32-1123, Airfield and Heliport Planning and Design, Attachment 14.

A14.2.3. All structures placed or constructed within the airfield environment must be made frangible unless otherwise noted in the definitions that follow or unless specifically described as exempt from frangibility requirements using the siting criteria in this manual. This applies for any above ground construction that is within 250 feet of the runway centerline and an extension of that dimension for 3,000 feet beyond the ends of the runway thresholds and within 200 feet of the taxiways. Frangibility implies that an object will collapse or fall over after being struck by a moving aircraft with minimal damage to the aircraft. The constructed object must not impede the motion or radically alter the path of the aircraft. Foundations for frangible structures shall be constructed flush with finished grade. Corrective action is required if more than three-inches of the vertical surface of any foundation is exposed above finish grade. All structures shall be designed to allow performance of the structure to withstand wind loads less than 70 MPH. At wind speeds and icing conditions above permissible airfield operations conditions, deflections shall remain within the elastic performance of the structure. Maximum deflection in structures used for housing or shelter shall be less than the constructed height divided by 180 for the maximum wind event considered.

A14.2.3.1. Frangible structures - Construction above the ground surface that will collapse or shatter upon impact. The structure must be designed using materials of minimum mass that will either break into segments or shatter without impaling the aircraft skin or becoming an obstacle to the continued movement of the aircraft.

A14.2.3.2. Frangible Support - Used for mounting fixtures or equipment items less than two meters (six feet) in height. The structure will be of minimum mass and will separate at the base connection when struck by a moving aircraft. Upon separation of the base connection, the support must not wrap around the aircraft, impale itself in the aircraft, nor cause the aircraft to alter its path.

A14.2.3.3. Low-Impact Resistant Support - Used for supporting elevated fixtures or equipment items more than two meters but less than 12 meters (6 to 40 feet) above the ground surface, typically towers or poles. Upon impact by aircraft, the structure will be designed to break away at or below the impact location and collapse without wrapping around the aircraft, impaling itself in the aircraft, or causing significant structural damage to the aircraft. The collapse may occur at a single point of failure or may be a segmented collapse. The structure shall be designed such that service of the equipment must be accomplished by lowering the equipment. The design shall not include elements that permit climbing by means of a built in ladder or other scaling devices.

A14.2.3.4. Semi-Frangible Support - Used for those elevated fixtures or equipment items that must be higher than 12 meters (40 feet). The structure will be constructed of multiple elements of low-impact resistant supports. The supports may be in pairs that provide directional stability or groups that provide stability to the grouping as an element. Upon impact by aircraft,

each of the supporting elements will collapse as a unit or in segments independent of the grouping. The elements of the supporting structure will not impale in the aircraft, wrap around the aircraft, or significantly change aircraft direction of travel upon impact. The group of elements may incorporate climb to service devices such as ladders provided they comply with applicable safety criteria.